

## Claims

1. A carbonylation process for the production of a carbonylation product by contacting carbon monoxide with a feed comprising an alcohol and/or a reactive derivative thereof in the vapour phase using an heterogeneous heteropolyacid catalyst comprising one or more metal cations selected from Cu, Fe, Ru, Os, Co, Rh, Ir, Ni, Pd  
5 and Pt, characterised in that there is also present in the feed at least 0.5wt% water.
2. A process according to claim 1 wherein the feed comprises 1 wt%, such as at least 2 wt%, preferably at least 5wt% water.
3. A process according to claim 1 or claim 2 wherein the feed comprises up to 20 wt%, such as up to 15wt% water.
- 10 4. A process according to any one of the preceding claims wherein the feed comprises 5 to 15wt% water.
5. A process according to any one of the preceding claims wherein the water in the feed is fresh and/or recycle water.
6. A process according to any one of the preceding claims wherein the  
15 heteropolyacid comprises 1 to 6 wt% metal cation(s).
7. A process according to any one of the preceding claims wherein the heteropolyacid catalyst comprises a metal cation selected from rhodium, iridium and copper.
8. A process according to claim 7 wherein the metal cation is rhodium.
- 20 9. A process according to any one of the preceding claims wherein the heteropolyacid comprises a peripheral atom selected from the group consisting of molybdenum, tungsten, vanadium, niobium, chromium and tantalum and a central atom selected from silicon and phosphorus.

10. A process according to any one of the preceding claims wherein the heteropolyacid is selected from the group consisting of substituted silicotungstic acids, silicomolybdic acids, phosphotungstic acids and phosphomolybdic acids.
11. A process according to any one of the preceding claims wherein the heteropolyacid comprises one or more further cations selected from residual hydrogen ions and alkali metal cations.
12. A process according to any one of the preceding claims wherein the heteropolyacid catalyst is supported on a support.
13. A process according to claim 12 wherein the support is selected from an oxide support and a non-oxide support.
14. A process according to claim 13 wherein the oxide support is selected from the group consisting of silica, alumina, silica-aluminas, zeolites, clays, diatomaceous earths and titania.
15. A process according to claim 13 wherein the non-oxide support is selected from the group consisting of silicon carbide, carbons and organic polymers.
16. A process according to any one of claims 12 to 15 wherein the heteropolyacid comprises 20 to 70 % by weight based on the total weight of heteropolyacid and support.
17. A process according to any one of the preceding claims wherein the alcohol is a C<sub>1</sub> to C<sub>12</sub> aliphatic alcohol.
18. A process according to claim 17 wherein the alcohol is selected from methanol, ethanol, propanol, isopropanol, the butanols, the pentanols and the hexanols.
19. A process according to any one of the preceding claims wherein the reactive derivative of the alcohol is selected from at least one of a dialkyl ether, an ester of the alcohol and an alkyl halide.
20. A process according to claim 19 wherein the reactive derivative is selected from at least one of methyl acetate, dimethyl ether and methyl iodide.
21. A process according to any one of the preceding claims wherein the feed comprises an alcohol and a reactive derivative thereof.
22. A process according to claim 21 wherein the reactive derivative is an ether or an ester of the alcohol.
23. A process according to claim 22 wherein the ether and/or the ester is present in an amount up to equimolar to the amount of water in the feed.

24. A process according to any one of the preceding claims wherein the carbonylation product is selected from at least one of a carboxylic and a carboxylic acid ester.

25. A process according to claim 24 wherein the carbonylation product is selected from at least one of acetic acid and methyl acetate.

26. A process according to any one of the preceding claims wherein the carbon monoxide to alcohol molar ratio is in the range 5: 1 to 15 : 1.

27. A process according to any one of the preceding claims wherein the feed also comprises hydrogen.

28. A process according to claim 27 wherein the hydrogen to carbon monoxide molar ratio is in the range 1 : 20 to 20 : 1.

29. A process according to any one of the preceding claims wherein the carbon monoxide is used in the form of synthesis gas.

30. A process according to any one of the preceding claims wherein the process is carried out at a temperature in the range 100 to 300 °C.

31. A process according to any one of the preceding claims wherein the process is carried out at a pressure in the range 1 to 100 barg.

32. A process according to any one of the preceding claims wherein the gas hourly space velocity is in the range 100 to 10000 h<sup>-1</sup>.

33. A process according to any one of the preceding claims wherein the process is carried out as a continuous process.

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